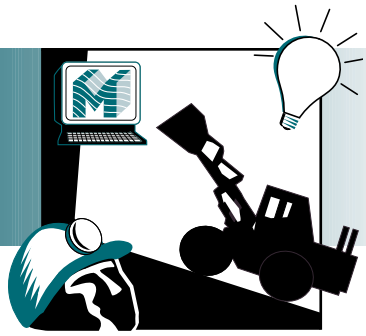
MINING

Project Fact Sheet



Development of a Lower-pH Copper Flotation Reagent System

A new reagent system improves recovery, reducing energy use and air emissions in the mining industry

Benefits

- Could save 92 billion Btu of natural gas per installation annually
- Could save 0.9 trillion Btu annually by 2010
- Reduces or eliminates lime and descaling reagents
- Reduces energy consumption in mining and processing limestone
- Could avoid 580,000 tons of CO_2 emissions from processing limestone into lime
- Improves mineral recovery

Applications

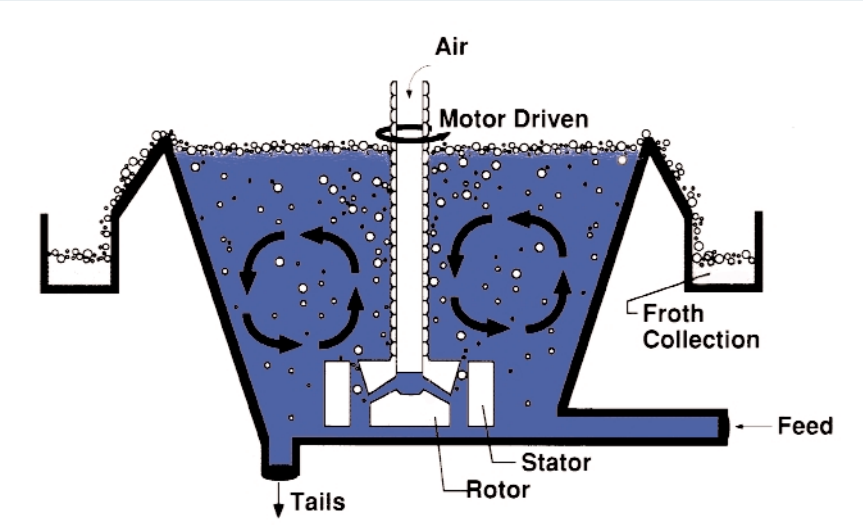
The new reagent-system technology is primarily applicable to the mining industry. The system allows a facility's separating processes to minimize or eliminate lime addition, improve mineral recovery, and reduce energy, emissions, and costs.

A new reagent system recovers copper minerals at much lower pHs than conventional reagents while not floating pyrite. The process reduces or even eliminates both the lime used in copper flotation and the accompanying carbon dioxide. The result is immediate cost and energy savings along with improved recovery of copper and other minerals.

In the mining industry, flotation is a process that concentrates minerals from their ores prior to metal recovery. Current practice uses slurry pHs in excess of 10, achieved by adding burnt lime (CaO). However, lime production is an energy-intensive process that releases large quantities of carbon dioxide into the atmosphere.

Furthermore, lime has several undesirable properties once it is in the flotation circuit. Lime produces scaling in piping and equipment, requiring the use of descaling reagents. It flocculates fine material and may occlude fine copper-sulfide particles. Lime increases the viscosity of the mineral slurry and tends to hinder aeration, slowing flotation kinetics. In addition, the calcium ion also has been shown to decrease recoveries of lead and molybdenum-sulfides and to reduce the recovery of free gold.

Copper Flotation Reagent System



This new technology, developed by Versitech, Inc., improves recovery of copper while reducing energy and the amount of chemicals needed as input.

Project Description

Goal: Develop a system of reagents that can allow mill flotation operators to reduce or eliminate the amount of lime used.

Lime is normally the most expensive chemical reagent used in the flotation of copper minerals, not because of its cost per kilogram but because of the high dosage required. Versitech, Inc., estimates that the annual lime cost of a 50,000 ton per day plant is $2.7 million with a standard reagent system. This cost can be halved, to $1.35 million, with Versitech's new reagent system.

Versitech proposes to develop this technology on a pilot-plant scale. While the existing system works well in laboratory tests, several issues need to be addressed on a larger scale. Frother response, cleaning losses, and tail characteristics are technical hurdles that Versitech plans to overcome through pilot-plant testing.

Versitech is developing this new technology with the help of a grant funded by the Inventions and Innovations Program in the U.S. Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- Acquire a sufficient ore sample from an operating mine for testing.
- Test collector and frother formulations at reduced pH.
- Analyze data and select the pilot-plant test reagents.
- Perform pilot-plant tests, comparing the conventional and new reagent schemes.
- Analyze the data to determine the best system of collectors, frothers, and flocculents.
- Replicate five pilot-plant runs with the chosen reagent system.
- Analyze data and generate a reagent flowsheet with a plan for commercialization.

Economics and Commercial Potential

The new reagent-system technology offers the mining industry the opportunity to reduce costs while improving product yield. According to the U.S. Geological Survey, 1.5 million metric tons of lime were used for the concentration of copper, gold, and other nonferrous metallurgical uses in 1998. Approximately 600,000 metric tons of lime were used in copper flotation. Producing this lime consumes about 2.3 trillion Btu annually and produces at least 580,000 metric tons of CO_2 in the United States; these amounts can be substantially reduced with the new system.

The main target for this technology will be the copper-sulfide flotation mills. In the United States, this industry buys approximately $14 million of flotation collectors and frothers and $30 million of lime annually. Extensive export opportunities also exist in South America and elsewhere in the world.

This technology could save 92 billion Btu of natural gas per installed unit each year. First sales for the technology are expected by 2003. Based on 40% market penetration by 2010, annual savings could be 0.92 trillion Btu with 10 units installed. Market penetration of 60% by 2020 could save 1.38 trillion Btu annually from the operation of 15 units.

Industry of the Future—Mining

In mid-1998, the National Mining Association reached an agreement with the U.S. Department of Energy's Industries of the Future Program to join in creating research and development partnerships to develop and deploy new technologies that will improve environmental performance and enable the industry to meet increased global competition. The mining industry supplies the minerals and coal essential to the infrastructure of virtually the entire U.S. economy: glass, ceramics, metals, and cement for buildings, bridges, roads, and equipment, and coal or uranium to generate more than 70% of the nation's electricity.

OIT Mining Industry Team Leader: J. Michael Canty (202) 586-8119.

The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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Order# I-MI-051
September 2001